REMARKS

Upon entry of the above amendment, claims 1-9 and 11-31 are pending in the application. Of these claims, 1, 9, 12, 15, 19, 21, and 23-31 are independent. Applicant believes that no new matter has been introduced by this Amendment. Reconsideration of the application in view of the above amendments and following remarks is respectfully requested. A copy of the above amendments showing deletions and insertions is attached to this Amendment (entitled "Attachment 1").

Rejections under 35 U.S.C. §102

The Examiner rejected claims 1, 2, 7, 8, 9, 10, 11, 23, 24, 26, and 27 under 35 U. S. C. §102(b) as being anticipated by U.S. Patent No. 4,818,865 to Funahashi *et al.* (*hereinafter* Funahashi). The present invention, as recited in claim 1, is directed to an image processing method that comprises a step of calculating a secondary difference value. The Examiner states on page 2 of the Office Action that Funahashi describes the step of calculating a secondary difference value.

However, Funahashi does not describe calculating a secondary difference value, as recited in claim 1. To highlight this distinction, claim 1 has been amended to further clarify the step of calculating a secondary difference. In particular, amended claim 1 recites that the secondary difference value is calculated from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which

represents a respective area. Support for this amendment can be found in the specification on page 12, lines 13-25.

The Examiner asserts that the following passage describes this feature of claim 1. "Expressing changes among image density levels at a predetermined number of picture elements in the vicinity of said edge of said recording region, which image density levels are represented by said sample image signals, by an approximate equation substantially constituted by a simple equation." Funahashi at col. 5, ll. 33-39. However, this passage does not appear to describe calculating a secondary difference value, as recited in claim 1.

Instead, this passage appears to describe a technique employed by Funahashi that involves the computation of straight line approximations from portions of an image density curve. Funahashi further describes techniques for calculating differences between these straight line approximations and the actual image density curve. Examples of these techniques are shown in Figures 3, 5, and 6 of Funahashi.

However, the differences calculated according to these techniques do not appear to be secondary differences, as recited in claim 1. This is because the differences calculated in Funahashi are not derived from differences between density values that each represent a respective area. Instead, these differences each appear to correspond to a single image location.

Independent claims 9, 23, 24, 26, and 27 have been amended in a similar manner to further clarify this secondary differences feature. Therefore, independent claims 1, 9, 23, 24, 26, and 27 are patentable over Funahashi. Claims 2, 7, 8, 10, and 11 depend from claims 1 and 9. Therefore, these claims are also patentable over Funahashi.

Rejections under 35 U.S.C. §103

The Examiner rejected claims 3-6 under 35 U.S.C. §103(a) as being unpatentable over Funahashi in view of U.S. Patent No. 5,495,536 to Osbourn (*hereinafter* Osbourn). Claims 3-6 depend from independent claim 1 and include additional features regarding the density values recited in claim 1. However, the Examiner only applies Osbourn to these additional features. Accordingly, in light of the analysis set forth above, claims 3-6 are patentable over Funahashi in view of Osborne.

The Examiner rejected claims 12, 13, 14, 15, 16, 17, 18, and 20 under 35 U.S.C. §103(a) as being unpatentable over Funahashi in view of U.S. Patent No. 5,732,149 to Kido *et al.* (hereinafter Kido). Independent claims 12 and 15 are each directed to image processing methods for judging whether an object area in an image includes an irradiation area.

Each of these independent claims includes a secondary difference value acquisition that is similar to the secondary difference step recited in claim 1. The Examiner asserts that this step is described in Funahashi. However, as set forth above, Funahashi fails to disclose this step. Accordingly, independent claims 12 and 15 are patentable over Funahashi in view of Kido. Claims 13-18 and 20 depend from these independent claims. Therefore, these claims are also patentable over Funahashi in view of Kido.

Claim Objections

The Examiner objected to claim 19 as being dependent upon a rejected base claim, but would otherwise be allowable. Claim 19 has been rewritten in independent form. Accordingly, Applicant requests that this objection be withdrawn.

CONCLUSION

In view of the above Amendment and Remarks, Applicants respectfully submit that all of the stated grounds of rejection have been properly traversed accommodated or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and objections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action, and, as such , the present Application is in condition for allowance.

AUTHORIZATION

The Commissioner is hereby authorized to charge any additional fees, which may be required for consideration of this Amendment to Deposit Account 13-4500, Order no. 1232-4532. A DUPLICATE OF THIS DOCUMENT IS ATTACHED.

In the event that an extension of time is required, or which may be required in addition to that requested in a petition for an extension of time, the Commissioner is requested to grant a petition for that extension of time which is required to make this response timely and is hereby authorized to charge any fee for such an extension of time or credit any overpayment for an extension of time to Deposit Account No. 13-4500, Order No. 1232-4532. A DUPLICATE OF THIS DOCUMENT IS ATTACHED.

Respectfully submitted,
MORGAN & FINNEGAN

Date filed: February 25, 2001

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ATTACHMENT 1

In this attachment, all additions are shown underlined (e.g., the), and deletions are shown in brackets (e.g., [the]).

IN THE CLAIMS:

Please cancel claim 10.

Please amend claims 1, 9, 12, 14-19 and 21-28.

Please add new claims 29-31.

1. (Amended) An image processing method comprising:

a step of determining a plurality of areas arranged in a predetermined direction on an image and each having a predetermined shape;

a step of calculating a secondary difference value [of density values representing the respective areas in said plurality of areas] from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in said plurality of areas; and

a step of judging [one]an end point of an irradiation area from said secondary difference values calculated in said calculating step.

9. (Amended) An image processing method [for extracting an irradiation area in an input image, said image processing method] comprising:

a step of detecting an irradiation end, based on a density distribution in each area, for a plurality of areas in a desired direction in said image; and

a step of evaluating [the]a result of said detection, based on [the result of]said detected irradiation ends for[detected for each of] said plurality of areas;

wherein said detection step comprises calculating a secondary difference value from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in each of said plurality of areas.

12. (Amended) An image processing method for judging whether an object area in an image includes an irradiation area, said method comprising:

a secondary difference value acquisition step of acquiring secondary difference values from [one-dimensional] image [data of said object area, said one dimensional image data comprising] a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in one-dimensional image data through said object area [said plurality of areas];

an irradiation end extraction step of extracting a coordinate of an end point of said irradiation area from the secondary difference values acquired in said secondary difference value acquisition step;

a comparison step of comparing the coordinate extracted in said irradiation end extraction step with a coordinate of an end point of the irradiation area included in said image, said latter coordinate being obtained preliminarily; and

a judgment step of judging whether said object area includes the irradiation area, based on a [the] result of the comparison in said comparison step.

14 (Amended) A method according to Claim 12, further comprising an accumulated image data production step of producing projection of [said object area as] image data in said image, thereby obtaining said one-dimensional image data,

wherein said irradiation end extraction step comprises a step of carrying out processing for the one-dimensional image data obtained in said accumulated image data production step.

15. (Amended) An image processing method for judging whether an object area in an image includes an irradiation area, said [image processing] method comprising:

a coordinate indication step of providing an indication of a plurality of [or] rows for which one-dimensional image data through said object area is to be extracted from said image [object area];

a secondary difference value acquisition step of acquiring secondary difference values from [the one-dimensional image data of said object area according to the indication in said coordinate indication step, said one dimensional image data comprising] a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in one dimensional image data of said plurality of rows according to the indication in said coordinate indication step [said plurality of areas];

an irradiation end extraction step of extracting coordinates of end points of said irradiation area from the secondary difference values acquired in said secondary difference value acquisition step;

a storage step of successively storing the coordinates extracted in said irradiation end extraction step;

an average acquisition step of acquiring an average of the plural coordinates stored in said storage step;

a comparison step of comparing the average of the coordinates obtained in said average acquisition step with a coordinate of an end point of the irradiation area included in said image, latter said coordinate being obtained preliminarily; and

a first judgement step of judging whether said object area includes the irradiation area, based on a [the] result of the comparison in said comparison step.

16. (Amended) A method according to Claim 15, wherein said first judgement step comprises a step of judging that said object area does not include the irradiation area, if the [coordinates] average and the latter coordinate area close to each other, or otherwise judging that said object area includes the irradiation area.

17. (Amended) A method according to Claim 15, further comprising a second judgment step which is carried out based on [the] a result of the judgment insaid first judgment step,

wherein said second judgement step comprises a variance acquisition step of acquiring a variance of the coordinate stored in said storage step, a variance comparison step of comparing the variance obtained in [the] said variance acquisition step with a predetermined value, and a judgment step of judging whether said object area includes the irradiation area, based on [the] a result of the comparison in the variance comparison step.

18. (Amended) A method according to Claim 16, wherein said second judgment step [comprises a step of carrying out each of the steps] carries out its each step when said first judgment step results in judging that said object area does not include the irradiation area.

19. (Amended) An image processing method for judging whether an object area in an image includes an irradiation area, said [image processing] method comprising:

a coordinate indication step of providing an indication of a plurality of [or] rows for which one-dimensional image data through said object area is to be extracted from said image [object area];

a secondary difference value acquisition step of acquiring secondary difference values from the one-dimensional image data [of said object area] according to the indication in said coordinate indication step;

an irradiation end extraction step of extracting coordinates of end points of said irradiation area from the secondary difference values acquired in said secondary difference value acquisition step;

a storage step of successively storing the coordinates extracted in said irradiation end extraction step;

an average acquisition step of acquiring an average of the plural coordinates stored in said storage step;

a comparison step of comparing the average of the coordinates obtained in said average acquisition step with a coordinate of an end point of the irradiation area included in said image, said latter coordinate being obtained preliminarily; and

a first judgement step of judging whether said object area includes the irradiation area, based on a [the] result of the comparison in said comparison step;

wherein said irradiation end extraction step comprises a step of carrying out said extraction of coordinate, based on a [the] sign, either positive or negative, of a primary difference value of said one-dimensional image data.

21. (Amended) An image processing method comprising:

[a coordinate indication step of indicating a row for calculation of characteristic quantities of two-dimensional image data,]

a characteristic quantity calculation step of calculating [said] characteristic quantities [from] of image data [or the row indicated in said coordinate indication step,];

an end point extraction step of extracting an end point of an object area in said image data from the characteristic quantities calculated in said characteristic quantity calculation step[,];

an end point storage step of storing coordinates of end points extracted in said end point extraction step [,];

a rotation angle indication step of indicating an angle of a rotation axis onto which the end points stored in said end point storage step are projected[,];

an accumulated quantity calculation step of calculating projection of the end points stored in said end point storage step onto said rotation axis of the angle indicated in said rotation angle indication step [,] and calculating an accumulated quantity of said projection of the end points in a conditioned area on said rotation axis;

an accumulated quantity storage step of storing [a projection] said accumulated quantity [onto said rotation axis,] calculated in said accumulated quantity calculation step [,]; and

a rotation angle judgment step of judging a rotation angle of the object area from said [projection quantity] accumulated quantities stored in said accumulated quantity storage step.

22. (Amended) A method according to Claim 21, wherein a start point of said rotation axis onto which the end points stored in said end point storage step are projected is placed at a barycenter of image data not less than a [fixed] predetermined density value.

23. (Amended) An image processing apparatus comprising:

means for determining a plurality of areas arranged in a predetermined direction on an image and each having a predetermined shape;

means for calculating a secondary difference value [of density values representing the respective areas in said plurality of areas] from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in said plurality of areas; and

means for judging an [one] end point of an irradiation area from said secondary difference values calculated by said calculating means.

24. (Amended) An image processing apparatus [for extracting an irradiation area in an input image, said image processing apparatus] comprising:

means for detecting an irradiation end, based on a density distribution in each area, for a plurality of areas in a desired direction in said image; and

means for evaluating a [the] result of said detection, based on said detected [the result of] irradiation ends for [detected for each of] said plurality of areas;

wherein said means for detecting comprises means for calculating a secondary difference value from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values, each of which represents a respective area in each of said plurality of areas.

25. (Amended) An image processing apparatus comprising: [coordinate indication means for indicating a row for calculation of characteristic quantities of two-dimensional image data.]

characteristic quantity calculation means for calculating said characteristic quantities [from] of image data [of the row indicated by said coordinate indication means,];

end point extraction means for extracting an end point of an object area in said image data from the characteristic quantities calculated by said characteristic quantity calculation means [,];

end point storage means for storing coordinates of end points extracted by said end point extraction means [,];

rotation angle indication means for indicating an angle of a rotation axis onto which the end points stored in said end point storage means are projected[.];

accumulated quantity calculation means for calculating projection of the end points stored in said end point storage means onto said rotation axis of the angle indicated by said rotation angle indication means [,] and calculating an accumulated quantity of said projection of the end points in a conditioned area on said rotation axis;

accumulated quantity storage means for storing [a projection] said accumulated quantity [onto said rotation axis,] calculated by said accumulated quantity calculation means [,]; and

rotation angle judgment means for judging a rotation angle of the object area from said [projection quantity] accumulated quantities stored in said accumulated quantity storage means.

26. (Amended) A computer-readable storage medium storing a program for carrying out an image processing routine comprising:

a step of determining a plurality of areas arranged in a predetermined direction on an image and each having a predetermined shape;

a step of calculating a secondary difference value [of density values representing the respective areas in said plurality of areas] from a plurality of primary difference values, wherein each primary difference value corresponds to a difference between density values each of which represents a respective area in said plurality of areas; and

a step of judging an [one] end point of an irradiation area from said secondary difference values calculated in said calculating step.

27. (Amended) A computer-readable storage medium storing a program for carrying out an image processing routine [for extracting an irradiation area in an input image, said image processing routing] comprising:

a step of detecting an irradiation end, based on a density distribution in each area, for a plurality of areas in a desired direction in said image; and

a step of evaluating a [the] result of said detection, based on said detected [the result of] irradiation ends for [detected for each of] said plurality of areas;

wherein said detecting step comprises calculating a secondary difference value from a plurality of primary difference values, wherein each primary difference value corresponds to a

difference between density values each of which represents a respective area in each of said plurality of areas.

28. (Amended) A computer-readable storage medium storing a program for carrying out an image processing routine comprising:

[a coordinate indication step of indicating a row for calculation of characteristic quantities of two-dimensional image data,]

a characteristic quantity calculation step of calculating [said] characteristic quantities [from] of image data [of the row indicated in said coordinate indication step,];

an end point extraction step of extracting an end point of an object area in said image data from the characteristic [quantity] quantities calculated in said characteristic [quantities] quantity calculation step[,];

an end point storage step of storing coordinates of end points extracted in said end point extraction step[,];

a rotation angle indication step of indicating an angle of a rotation axis onto which the end points stored in said end point storage step are projected[,];

an accumulated quantity calculation step of calculating projection of the end points stored in said end point storage step onto said rotation axis of the angle indicated in said rotation angle indication step[,] and calculating an accumulated quantity of said projection of the end points in a conditioned area on said rotation axis;

an accumulated quantity storage step of storing [a projection] said accumulated quantity [onto said rotation axis,] calculated in said accumulated quantity calculation step[,]; and

a rotation angle judgment step of judging a rotation angle of the object area from said [projection quantity] accumulated quantities stored in said accumulated quantity storage step.

29. (New) An apparatus for a radiographic image, comprising:

a determination unit adapted to determine a plurality of discrete positions arranged in a direction on a radiographic image;

a calculation unit adapted to calculate a characteristic on the basis of values of said radiographic image at each successive three of said discrete positions; and

a judgment unit adapted to determine an end point of an irradiation area in said radiographic image on the basis of said characteristics calculated by said calculation unit.

30. (New) A method of processing a radiographic image, comprising:

a determination step of determining a plurality of discrete positions arranged in a direction on a radiographic image;

a calculation step of calculating a characteristic on the basis of values of said radiographic image at each successive three of said discrete positions; and

a judgment step of determining an end point of an irradiation area in said radiographic image on the basis of said characteristics calculated in said calculation step.

31. (New) A computer-readable storage medium storing a program for carrying out a method of processing a radiographic image, said method comprising:

a determination step of determining a plurality of discrete positions arranged in a direction on a radiographic image;

a calculation step of calculating a characteristic on the basis of values of said radiographic image at each successive three of said discrete positions; and

a judgment step of determining an end point of an irradiation area in said radiographic image on the basis of said characteristics calculated in said calculation step.